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DRINK
KAO CORP
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Abstract:

PURPOSE: To obtain a drink capable of suppressing multiplication of bacteria to cause tooth decay in the oral cavity, containing oxygen in an amount exceeding the amount of oxygen which can be contained at normal temperature under normal pressure.

CONSTITUTION: A drink, especially drink containing sugar contains oxygen in an amount exceeding the amount of oxygen which can be contained at normal temperature under normal pressure (15W25°C under 1atm) preferably in a dissolved state in a solution to give a drink which suppresses multiplication of Streptococcus mutans, tooth decay bacterium, to synthesize polysaccharides having high adhesion from sugar and to promote formation of bacterial plaque and can prevent tooth decay.

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Title of the Invention: A Drink

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SPECIFICATION

1. Title of the Invention

A drink.

2. Scope of Patent Claims

1. A drink characterised in that it contains oxygen in an amount which exceeds the amount of oxygen that can be contained at normal temperature and pressure.

2. The drink disclosed in Claim 1 where the oxygen in an amount that exceeds the amount of oxygen that can be contained at normal temperature and pressure exists in a dissolved state in the liquid.

3. The drink disclosed in Claims 1 or 2 which contains cane sugar as a sweetener.

3. Detailed Explanation of the Invention

Field of Industrial Application

The present invention relates to a drink that is effective in preventing tooth decay. In further detail it relates to a drink that can suppress the breeding of oral bacteria, whch become a cause of tooth decay.

Prior Art

Tooth decay is something that occurs because bacteria living in the tooth tartar that forms on the surface of teeth metabolise the sugars in food and the teeth are delimed by the acid produced. It is known that the occurrence of tooth decay increases with the amount of sugar intake. This is because, among tooth tartar bacteria, Streptococcus mutans (hereinafter referred to as 'S.mutans') synthesises highly adhesive polysaccharides from cane sugar and promotes the formation of tooth tartar. Hence S.mutans is said to be the cause of tooth decay.

Incidentally, cane sugar is contained in various foods, but many drinks, particularly refreshing drinks, contain the large amount of some 10% cane sugar. For protection from this, attempts have been made to substitute other sweeteners that do not cause tooth decay for cane sugar, for example, aspaltame [translit.] or stepiocide [translit.] or parathinose.

Problems to Be Overcome by the Invention

However, there was the problem that many of the substitute sweeteners had a poorer quality of sweetness than cane sugar and were expensive and so on. Furthermore, substitution of sweeteners is a negative method. If one considers that, of the total intake of cane sugar, that derived from drinks is extremely little, it is hard to say that this method is a fundamental method for the prevention of tooth decay.

In order to prevent tooth decay positively it is desirable to have some means in the drink of suppressing the breeding of S.mutans. It is known that tooth protecting agents such as chlorohexidene salts and suchlike have an action that suppresses the breeding of S.mutans, but if they are added to drinks there are the problem of toxicity and problems such as disturbing the balance of bacteria in the intestines.

Means of Overcoming the Problems

In such a situation, the inventors of the present invention carried out diligent research and, as a result, they discovered that S.mutans could grow well enough in ordinary water in which air was dissolved but its growth was greatly inhibited in the presence of a high concentration of oxygen; consequently tooth decay could be prevented if a high concentration of oxygen was made to be present in drinks and these were consumed; and so they completed the present invention.

That is to say, this invention is one which provides a drink containing a quantity of oxygen exceeding the oxygen content that can be contained at normal temperature and pressure.

In this Specification, normal temperature and pressure denote 15~25°C and 1 atmosphere. An oxygen content exceeding the oxygen content that can be contained at normal temperature and pressure is called a 'high oxygen concentration'.

Nearly all the liquid in drinks is water, but oxygen dissolves in water with extreme difficulty. Even if air is passed through water at normal temperature and pressure, a long time is required for the degree of dissolved oxygen to reach saturation. Moreover, this saturation is 8ppm at most and the effect of preventing tooth decay described above cannot be achieved with this.

To obtain the drink of this invention, drink is put into a sealed container. High pressure oxygen is introduced to this and oxygen is made to dissolve in a high concentration in the said drink. Fig.1 shows the change of oxygen concentration in the water with the passage of time when a sealed container in which water had been put was filled up with oxygen at a pressure of 4.2 atmospheres. 100mml of water was put into a plurality of sealed containers with a 200ml internal volume and they were filled up with oxygen at 25°C and 4.2 atmospheres. The containers were unsealed after fixed intervals of time and the water in them was sampled. The oxygen content was titrated by the Winkler method. The x-axis of Fig.1 shows time and the y-axis shows oxygen concentration. From this it was seen that the oxygen concentration increased and about 5 hours were required before it was finally saturated and the concentration became fixed. The amount of dissolved oxygen becomes higher the larger the pressure under which the oxygen is filled up, but, giving consideration to such things as the strength of the container and the danger of the oxygen gas spurting out when it was unsealed, it is undesirable for the oxygen pressure to be too high and a pressure of 15 atmospheres at the highest is suitable. A better effect is given when the oxygen is present in a state where it is dissolved in the water rather than if it is present as minute bubbles. The dissolved oxygen is gradually lost if the water in which this high concentration of oxygen is dissolved is taken out from the sealed container into the environment at normal pressure, but it does not go down to the saturated concentration in a short time at normal temperature and pressure. Fig.2 is one

where measurement has been made of the oxygen concentration at fixed intervals of time where water that has been saturated with oxygen at 2.0~6.3 atmospheres is taken out into the environment at normal temperature and pressure. The titration method was by the Winkler method, as in the case of Fig.1. The x-axis shows time and the y-axis shows oxygen concentration. It can be seen from Fig.2 that the oxygen concentration is kept high for a comparatively long time. In the one that was filled at 6.3 atmospheres, even after 2 hours oxygen was dissolved at a concentration of 57ppm, that is to say, more than 7 times the 8ppm saturation concentration from oxygen in the air.

Consequently, with regard to the drink of the present invention it is desirable for it to be put into a sealed container such as a bottle or a can, dissolve oxygen in it at a maximum pressure of 10 atmospheres in the case of a can and under 5 atmospheres in the case of a normal glass bottle and then seal it. Further, cane sugar can be added to this drink as a sweetener and there is no concern even so about causing tooth decay on account of the cane sugar.

Operation

Next, the results of tests of the action of the drink of this invention, which had been made to contain a high oxygen concentration, on suppressing the breeding of S.mutans in the mouth will be shown. In these tests, the water in which a high oxygen concentration was dissolved (hereinafter referred to as 'oxygen water') was administered once daily to hamsters infected with S.mutans and the growth of S.mutans was examined. That is to say, first of all, drinking water containing a 200μg/ml streptomycin sulphate was freely imbibed for 3 days by 20 4 week old male golden hamsters and oral bacteria were suppressed. Then a dispersion liquid of streptomycin-resistant S.mutans OMZ-176 (10^8 bacteria/ml) was innoculated once daily, 0.2ml at a time, for 3 days and S.mutans were made to be lodged in the mouth. During the period of the tests the hamsters were given feed containing a large amount of cane sugar (Diet 2000) to promote the formation of tooth tartar.

The hamsters that had been thus infected with S.mutans were separated into 2 groups with 10 in each. One group was made to drink oxygen water and the other group, for comparison, was made to drink nitrogen water, 4ml at a time once daily for 7 days continuously, using a syringe. The oxygen water and nitrogen water used in these tests were saturated by filling up sealed containers at 6.0 atmospheres for the oxygen and normal pressure for the nitrogen and the water was used immediately after opening the sealed containers. The tartar on the teeth of the hamsters was removed on the 7th day after starting the tests with a sterilised applicator, suitably diluted with physiological saline solution and then 0.1ml was applied to a GAM agar-agar plate culture (made by Nissui Seiyaku (KK)) and an MS agar-agar plate culture containing 0.01% streptomycin sulphate (a streptococcus selective culture). It was cultivated for 48 hours at 37°C in air and the number of colonies produced was measured.

From the number of colonies in the GAM agar-agar plate culture the total number of aerobic bacteria and common anaerobic bacteria in the tooth tartar was calculated and from the number of colonies in the MS agar-agar plate culture the number of S.mutans bacteria was calculated. In addition, the ratio of the number of S.mutans bacteria to the total number of aerobic bacteria and anaerobic bacteria in the tooth tartar was found. The results are shown in Fig.3. The y-axis expresses the ratio of the number of S.mutans bacteria to the total number of aerobic bacteria and anaerobic bacteria in the tooth tartar. It can be seen from Fig.3 that the S.mutans ratio for the hamsters dosed with oxygen water has become significantly lower than that for the ones dosed with nitrogen water.

Practical Embodiments

Next, a more detailed explanation of the present invention will be made by showing practical embodiments, but this invention is not limited to these practical embodiments.

Practical Embodiment 1 (Refreshing drinking water)

Cane sugar	12.0 wt%
Citric acid	0.5
Table salt	1.0
Colourants (food additives)	small amount
Spices	small amount
Pure water	the balance
Total	100.0 wt%

A solution of the above composition was put in a sealed container. This was filled up with oxygen gas at a pressure of 5.0 atmospheres and left for 5 hours at normal temperature. Refreshing drinking water was obtained in which a high concentration of oxygen was dissolved.

Practical Embodiment 2 (Refreshing drinking water)

Cane sugar	10.0 wt%
Citric acid	0.7
Natural caffein	0.05
Caramel	small amount
Spices	small amount
Pure water	the balance
Total	100.0 wt%

A solution of the above composition was put in a sealed container. This was filled up with oxygen gas at a pressure of 2.0 atmospheres and oxygen gas at a pressure of 5.0 atmospheres and left for 5 hours at normal temperature. Refreshing drinking water was obtained in which a high concentration of oxygen was dissolved.

Effect of the Invention

The drink of this invention can prevent the occurrence of tooth decay by preventing the breeding of the tooth decay bacteria S.mutans in the mouth.

4. Brief Explanation of the Diagrams

Fig.1 is a diagram showing the change with time of the oxygen concentration in water when high pressure oxygen is passed into it. Fig.2 is a diagram showing the change with time of the oxygen concentration when water containing a high oxygen concentration is left under normal pressure. Fig.3 is a diagram showing the effect of water containing a high oxygen concentration in suppressing the breeding of S.mutans.

[Diagram Captions]

Fig.1

[y-axis] Oxygen Concentration

[x-axis] Time

Fig.2

[y-axis] Oxygen Concentration

[x-axis] Time

(1) Water saturated with oxygen at a pressure of 6.3 atmospheres

(2) Water saturated with oxygen at a pressure of 4.0 atmospheres

(3) Water saturated with oxygen at a pressure of 3.0 atmospheres

(4) Water saturated with oxygen at a pressure of 2.0 atmospheres

Fig.3

[y-axis] Ratio of S.mutans to the total number of bacteria

[x-axis]

[left] Group dosed with nitrogen water

[right] Group dosed with oxygen water